

## Benefit-Cost Evaluation of SRI Safety Improvements

A research study by the Midwest Research Institute in cooperation with the Traffic and Highway Safety Divisions

### MoDOT Summary Statement

*Based on the results from this research, MoDOT may confidently proceed with future striping and delineation improvements knowing that such improvements make a substantial contribution to safety and that they are well received by the motoring public. Significant findings from the study included:*

- ♦ *Fatal and disabling injury accidents were reduced by 8 percent on SRI routes.*
- ♦ *Missouri received an estimated \$9.70 in benefits for every dollar spent.*
- ♦ *Wider stripes combined with both centerline and edgeline rumble strips on resurfaced rural two-lane highways provided a benefit-cost ratio of 59.*
- ♦ *There were significant reductions in nighttime fatal and disabling injury crashes (ranging from 25 to 77 percent) for rural freeways, rural multilane divided highways, and rural two-lane highways.*
- ♦ *A survey of Missouri motorists indicated that 79 percent believe the improvements have been a good investment of taxpayer dollars and 80 percent indicated MoDOT should implement similar improvements more widely in the future."*

### Background

In 2006, the Missouri Department of Transportation completed a major program, known as the Smooth Roads Initiative, which improved both the rideability and the visibility of more than 2,300 miles of major roadways in Missouri. The SRI program included most of the Interstate system in Missouri, as well as freeways and expressways; some multilane and two-lane undivided roads were included.

The striping and delineation improvements in the SRI program included:

- Wider and higher-visibility lane lines,
- Wider edgelines with rumble stripes or shoulder rumble strips,
- Centerline rumble strips (*on undivided highways only*),
- Roadside barrier (*guardrail*) improvements,
- Barrier-mounted delineators (*on concrete barriers, guardrails, and cable barriers*), and
- Emergency reference marker signs (*on Interstate highways only*).

The objectives of this research were to:

- Evaluate the safety effectiveness of SRI improvements (*including specific combinations of improvement types*),
- Perform a benefit-cost evaluation using the safety evaluation results together with improvement cost data, and
- Assess public perception or satisfaction with improved striping and delineation.

### Results

A before-and-after evaluation was performed using the Empirical Bayes method to estimate the safety effectiveness of specific striping and delineation improvement packages used in the SRI program. The striping and delineation program resulted in an overall reduction of 8 percent in fatal-and-disabling-injury crashes and 6 percent in fatal-



### Results (cont'd.)

and-all-injury crashes. The evaluation results for total crashes (*all crash severity levels combined*) were not statistically significant. Lack of statistical significance is to be expected in some cases because only one year of data were available for the study period after implementation of the striping and delineation improvements.

Twenty-four specific combinations of roadway type and project type (*i.e., striping and delineation packages*) were evaluated and statistically significant results were found for 11 combinations. The effectiveness of these striping and delineation packages in reducing injury crashes ranged from 11 to 86 percent. The striping and delineation improvements appear to be particularly effective in reducing multiple-vehicle crashes on the improved roadways. By contrast, single-vehicle crashes appear to have increased, but this is likely to have resulted from a statewide trend of increases in lane-departure crashes rather than from an effect of the striping and delineation improvements.

Over a period of five years from 2007 through 2011, the striping and delineation program is expected to reduce approximately 50 fatal crashes; 300 disabling injury crashes; 1,100 nondisabling injury crashes; and 3,800 property-damage-only crashes. The overall results are important because they show that the SRI program was an excellent investment in safety improvement for MoDOT.

A benefit-cost evaluation was performed for each combination of roadway type and striping and delineation package for which there was sufficient data to obtain a reliable safety effectiveness estimate. These projects had an overall benefit-cost ratio of 9.7. In other words, the projects provided \$9.70 in benefits for each dollar invested in improving striping and delineation. While all of the roadway type/project type combinations that could be assessed had benefit-cost ratios substantially greater than 1.0, five specific project types stand out as being particularly cost-effective. These are:

- ♦ Wider markings without resurfacing on urban freeways (*benefit-cost ratio = 129*)

- ♦ Wider markings with resurfacing on rural multilane undivided highways (*benefit-cost ratio = 91*)
- ♦ Wider markings without resurfacing on rural freeways (*benefit-cost ratio = 64*)
- ♦ Wider markings and both centerline and edgeline rumble strips with resurfacing on rural two-lane highways (*benefit-cost ratio = 59*)
- ♦ Wider markings and shoulder rumble strips with resurfacing on urban multilane divided highways (*benefit-cost ratio = 27*)

A survey of Missouri motorists was conducted to assess public perception and satisfaction with the striping and delineation treatments that are part of the SRI packages. The survey found that nearly 87 percent of respondents have noticed the new SRI improvements. The improvements most noticed by respondents are the rumble strips, followed by the improved visibility of the new lane markings. Fifty-three percent of survey respondents found the edgeline and lane line improvements to be helpful. Fifty-six percent of survey respondents indicated that shoulder and centerline rumble strips were helpful in preventing drivers from leaving their lane unintentionally. More than half of survey respondents (*57 percent*) believe the striping and delineation improvements increase the general level of safety on Missouri roadways. A substantial majority of respondents (*79 percent*) believe the improvements have been a good investment of taxpayer dollars and 80 percent of respondents would like to see these improvements implemented more widely in the future.

### Recommendations

MoDOT should repeat the safety evaluation in 2009 or 2010 with more after-period data. It is also recommended that MoDOT consider evaluating the safety effectiveness of the Better Roads, Brighter Future program.